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ABSTRACT

The literature on medical education does not contain many studies directly concerning ATI (Aptitude-Treatment Interaction) or more broadly TTI (Trait-Treatment Interaction), in spite of the great many studies on the characteristics of medical students. Nevertheless, a project at Michigan State University was begun in which an entry profile of all entering medical students was compiled in the hope of maximizing the potential of both the students and the program. In the third year of the project the effort was expanded to study the interactions affecting two treatments judged important in their own right. While statistical significance was achieved, practical significance was not great enough. It is concluded that research in this area may not be of practical value for decision making in higher education. (WH)

Interaction Studies in University Education: A Search for TTI's in a Medical School (A personal and empirical quest)

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Whenever I question the value of searching for ATI's (Aptitude-Treatment Interactions) or more broadly, TTI's (Trait-Treatment Interactions), I find myself reminded of the fable[1] in which the animals had a school. The curriculum had courses in running, climbing, flying and swimming and everyone studied all the subjects. Of course, the duck was better than his instructor in swimming but failed running. The squirrel led the climbing class, but was a hopeless flyer. In the end, an abnormal eel who did everything a little bit was made valedictorian. With a background in early childhood education, I find myself loath to ignore the damages inflicted by group-oriented and norm-referenced curricula. Early grade teachers, like physical therapists, are well indoctrinated to build upon the strengths, however little, with which the pupil or patient presents. Within this context to view TTI's with disfavor is to spite all one's efforts.

Most research on TTI's has, in fact, used school-aged populations (Berliner and Cahen, 1973) and mine has been no different. I moved from maximizing the learning of young children in the classroom to doing research that tested the assertion of one elementary school science program that it enhanced the learning of non-readers (Sher, 1971). From there, it seemed natural to continue my search with older subjects and

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more complex situations. So, I found myself in a new and innovative medical setting striving to educate medical students whose futures were to involve the delivery of care for real-world patients. The specific nature of this task is no less ambiguous than it is ambitious. Then, add the assumption that combining the educational innovations of recent years produced better doctors and the result is a combination of partial things, all of them "good" -- individualizing the curriculum, specifying educational objectives, evaluating mastery learning, stimulating clinical problems...(Anderson, 1974). Looking for TTI's in this setting poses real challenges not only because there is no real variance in the criterion measures of mastery learning but because the literature is already replete with research that demonstrates that treatment differences produce equivocal results at best (North, 1967; Raney, 1968; Merrill, Yaryan and Musser, 1959; Golden and Liston, 1972; Sher and Adams, 1973). As early as 1965, Sanazaro warned us that most treatment differences would wash out with medical students because these students "will perform in whatever manner required to graduate from medical school" (Sanazaro, 1965, p. 39). We stood warned and yet, we continued our search, looking for those characteristics on which medical students differ from one another. Variance in one dimension would be a beginning.

History should have been of some help in identifying these characteristics. In 1956, the Association of American Medical Colleges (AAMC) in cooperation with the Institute of Higher Education at the University of California began a longitudinal study of the entering classes at 28 medical schools (Hutchins, 1964). 2,800 students participated in the

study and from these students, personality, academic performance and medical school environment data were gathered. Most of the results were less than astonishing; just to mention one -- medical schools which are more well-endowed financially turn out a higher percentage of researchers and teachers than do less well-endowed medical schools. However, the findings that : "student bodies do vary in their ability to learn. They vary from school to school, from class to class, and from student to student within a class" (ibid., p. 268) present a major problem to educators attempting to design environments for so unstable a population.

Add to these findings that fact that at least half the 120 medical schools in North America do some kind of entry testing with their newly admitted students (D'Costa and Schafer, 1972); yet, a recent bibliography listed only 52 citations of published research examining personality characteristics of medical students or physicians (Schofield, 1972). Maybe a dozen of these examined interactions between personality measures and some kind of performance. We should have been alerted by the sparseness of the yield and if not by that, by the quality of the research in print. Specifically, these studies are plagued by a lack of replicability (Beiser and Allender, 1964; Beiser, 1967) by predictors which are statistically significant but small (Hufhines and Hanes, 1972) or by sets of correlations to which significance could be ascribed to a chance event (Parker, 1958, Juan, Gaga, and Haley, 1969; Griesen, 1971). There are a few well-designed studies with reproducible results. One of these (Gough and Hall, 1964; Gough, 1967) suggests that we add specific personality criteria to our selection process because these measures

do correlate with clinical performance. Another (Briggs-Myers and Davis, 1964) suggests that personality variables have their greatest utility in predicting post-medical-school, specialty choice. In a recent review, Shulman and Elstein (1971) suggest several approaches to modifying admissions procedure and improving personality assessments. It is of interest however that despite the findings that the usual admissions criteria -- GPA (Grade Point Average) and MCAT scores -- (Medical College Admittance Test) do not predict a student's success in medicine, selection committees rarely consider the addition of other, non-intellectual measures to their armament.

Undaunted by the apparent lack of productivity in this type of research from either medical education or other fields of higher education (Stern, Stein and Bloom, 1956; Dubin and Taveggia, 1968), we started our own Entry Profile[2] hoping to maximize the potential of both the students and the program. The first year, we asked the entering students to respond to a battery of questionnaires, personality scales, attitude inventories, aptitude tests and achievement measures. We hoped to cull from the 44+ scores, a smaller battery of non-redundant and reliable measures for individualizing the curriculum. All the measures turned out to be reliable and non-overalapping.

Instead of adopting a curriculum that was individualized for each student, the school adopted a curriculum organized around medical problems and in which a large percentage of the instructional time was spent in small group discussions of these problems. When this small group format was adopted, in the second year, we were granted a reprieve. The Entry

Profile, however, assumed a functional autonomy and now 84+ scaores formed the data pool from the incoming class. Ostensibly, continuation of the data gathering was justified by a need for longitudinal data and by a desire to improve student advisement. In the third year, justification for subjecting the entering class to a week of testing came from the earlier rationale as well as from the needs of two research projects. One of these examined these data in relationship to student preferences for two curricular tracks. It is this research that brings me here today.

In 1971, Snow (1971) suggested that one way to do research on TTI's in medical education would be to "begin with treatments that are important in their own right and choose or design personality measures to identify individuals particularly well-suited for each" (Snow, 1971, p. 134). It is precisely this design that we were able to use. As soon as the school moved to the new curriculum described above, there was pressure from some faculty and students for a curriculum with even less time in lectures, less structure and more options for independent study. A second track was added to the curriculum and students were given the option of choosing between the one track which combined small groups and lecture and a second track which combined small groups with independent study supported by a myriad of technological aids (Sher, 1974b).

We asked ourselves on what characteristics would the students who opted into this second track differ from their classmates who select a less media-supported and more structured program. Our data shows that these groups differed in statistically significant ways. Specifically, the students opting for the less structured track are less dogmatic

(Rokeach, D-scale), have a higher tolerance for novel situations (Omnibus Personality Inventory, C-scale), have a greater sense of control over their academic performance (Schneider, Locus of Control), recognize the role of social factors in a patient's environment (Rothman, Medical Opinion Survey) and have higher scores on the MCAT (Medical College Admittance Test) -- Verbal, General Information and Science -- subtests than their classmates. On the surface, these results are not remarkable.

However, we found ourselves in need of information to aid in the selection of students for a small, experimental medical program to be located in the rural, out-back Upper Peninsula of Michigan. This program was modeled on the second track and was to be heavily based in media-supported independent study. Selecting students on the traits listed above might be importance and justifiable, but we felt replication would be a necessary prerequisite. We replicated the study on a second class and found that only two of the significant differences overlapped with the set found in the first year; one of these -- the sense of control over academic performance -- showed the opposite relationship the second year. The one variable that did replicate as a predictor of choice was the scale measuring the student's tolerance for novel situations. Certainly, this is a desirable trait, especially for coping in the Upper Peninsula but it is difficult to justify selecting students on a variable which accounts for as little as 10% of the variance.

I find myself unconvinced that research in this area can have practical value for decision making in higher education. Studies examining theoretical issues (Shulman, Loupe, and Piper, 1968) have found significant interactions using extreme groups of subjects. By contrast, a recent,

Table I

Table 1

Selected Entry Profile Data

Test	1972 Mean Small Group & Independent Study Track	1972 Mean Small Group & Lecture Track	1972 F	1972 p	1972 Omega Squared	1973 Mean Small Group & Independent Study Track	1973 Mean Small Group & Lecture Track	1973 F	1973 p	1973 Omega Squared
MCAT										
Verbal	596.66	493026	23.32	<0.001	.255	567.63	543.98	.98	.323	.011
Quantitative	588.33	538.04	3.88	.053	.054	588.15	555.98	1.93	.168	.022
General Information	569.16	501.30	13.02	.001	.160	561.31	538.76	1.02	.314	.001
Science	570.41	515.65	7.82	.007	.103	553.42	539.59	.28	.596	.003
Dogmatism	-25.43	-16.94	8.05	.006	.101	-16.00	-13.36	1.5	.214	.019
Flexibility	-1.13	5.34	3.95	.051	.052	-4.82	2.42	6.5	.012	.077
Complexity	8.91	-7.22	12.45	.001	.149	8.88	.26	6.15	.015	.073
Locus of Control										
Academics	12.00	11.18	4.31	.042	.058	11.31	12.75	5.90	.017	.070
Medical Opinion Survey										
Social Factor	29.39	31.78	4.36	.040	.060	16.05	17.29	.88	.348	.011
Government Role	32.04	31.14	.68	.410	.010	25.22	19.72	13.70	<0.001	.151

real-life study (Goldberg, 1972) using undergraduate psychology students five criteria of learning, two experimental treatment and 300+ a priori personality measures yielded a few dozen significant interactions, all of which could be chance and all of a magnitude no greater than .40.

Professional education finds itself in a strange bind. We are at the same time training professionals to cope with an nvironment and hoping that as soon as they enter the field they will change it in significant ways. Environmental design may be the direction in which to look. Others have found significant interactions here. Stern (1962) found interactions among student traits, college environments and the manner in which students cope with their learning tasks -- study habits and activities. Moreover, the finding that students in the independent study track at the Ohio State Medical School hold their medical school and education in higher esteem than their peers in the regular track has been replicated for three consecutive years (Griesen, 1974). This attitude change may represent a beginning rapproachement between the ivory tower medical center and the local practicing physician. I have suggested in another paper (Sher, 1974a) and repeat here than designing educational environments that require the desired outcomes as daily behaviors seems a likely route to follow. At present, the most sophisticated attempts in the design of medical environments come from simulation techniques (Office of Medical Education Research and Development, 1973).

At times, I find myself wondering if these techniques could be used to bring student doctors to adopt the horse-and-buggy once again (Freedman, 1959). Then, we could solve the energy problem as well.

Notes

1. A Curriculum Fable, Anonymous

   One time the animals had a school. The curriculum consisted of running, climbing, flying, swimming, and all the animals took all the subjects.

   The Duck was good in swimming, better in fact than his instructor, and he made passing grades in flying, but he was practically hopeless in running. Because he was low in this subject he was made to stay in after school and drop his swimming class in order to practice running. He kept this up until he was only average in swimming. But average is acceptable, so nobody worried except the Duck

   The Eagle was considered a problem pupil and was disciplined severely. He beat all the others to the top of the tree in the climbing class, but he used his own way of getting there.

   The Rabbit started out at the top of the class in running, but he had a nervous breakdown and had to drop out of school on account of so much make-up work in swimming.

   The Squirrel led the climbing class, but his flying teacher made him start his flying lesson from the ground up instead of the top of the tree down, and he developed charley horses from over-exertion at the take-off and began getting C's in climbing and D's in running.

   The practical Prairie Dogs apprenticed their offspring to a Badger when the school authorities refused to add digging to the curriculum.

   At the end of the year, an abnormal eel, that could swim fairly well, run, climb, and fly a little, was made valedictorian.

2. Copies of the Entry Profile Student Report for 1971, 1972, and 1973 may be obtained from the Office of Student Affairs, College of Human Medicine, Michigan State University.

3. Ronald Richards, Upper Peninsula Project Report, Office of Medical Education, Research and Development, Michigan State University, Lansing, 1974.

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